June 10, 2021

FCC Wireless Telecommunications Bureau Request for Comment on the Impact of the Global Semiconductor Shortage on the Communications Sector

WT Docket No. 21-195[1]

DA 21-550

The American Automotive Policy Council (AAPC) – representing American Automakers Ford Motor Company, General Motors Company and Stellantis – wishes to commend the attention that the Biden Administration has given to securing and strengthening America's supply chains – as demonstrated by the Executive Order (E.O. 14107) it issued on "America's Supply Chains" within the first days of the new Administration.

The following is the input provided by AAPC in response to the Federal Communications Commission (FCC) Wireless Telecommunications Bureau request for comment on the impact of semiconductor supply chain constraints and other supply chain challenges on the communications sector, and on steps the FCC can take to ensure a resilient supply chain for communications technologies now and in the future.

Introduction

Increasingly, the lines between the automotive and communications sectors have become blurred as the automobile has also become a communication hub. This trend of the automobile expanding its overall communication role is expected to accelerate in the coming years. Already, communication technologies, such as Wi-Fi, Bluetooth, and RF transmitters, provide vehicle users with access to important information. It also supports remote keyless entry, tire pressure monitoring systems, and other safety and convenience services for drivers and their passengers.

As automobiles adopt more communication technologies on the path to becoming more autonomous, including vehicle-to-vehicle and vehicle-to-infrastructure communication, the auto sector will rely even more on access to semiconductors. However, without a stable and trustworthy supply of auto grade semiconductors, automakers may be forced to bypass integration of these innovative technologies into the vehicles they build – disappointing the consumer, slowing down auto innovation, and undermining the global competitiveness of the U.S. auto industry. This is already begun to happen during the current semiconductor shortage crisis.

[1] https://docs.fcc.gov/public/attachments/DA-21-550A1.docx

The U.S. automotive sector has among the longest, most complex supply chains in the U.S. economy- making it particularly vulnerable to supply chain disruptions. While market-based solutions are generally preferred, there is a growing recognition of the need for the U.S. government to play a more active role to improve supply chain resiliency and reduce the national security/economic risk associated with the industry's reliance on foreign semiconductor wafer/chip makers.

Economic Impact of American Automakers

American Automakers spend approximately $20 billion annually on research and development (R&D) investments in their U.S. assembly, engine and transmission plants, R&D labs, headquarters, administrative offices, and other infrastructure that connects and supports them.[2] Ford, General Motors and Stellantis produced 4.6 million vehicles in the U.S. in 2020, which is on track to rebound in 2021, assuming that the chip shortage and shortages of other essential inputs does not stand in the way.[3] This would be accomplished with the help of 241,000 U.S. employees – most of whom are members of organized labor unions – at 260 assembly plants, manufacturing facilities, research labs, distribution centers, and other facilities across 31 states in 128 congressional districts. They work with and support nearly 9,700 dealerships, which employ nearly 660,000 U.S. workers.

The Auto Sector Supply Chain

The U.S. automotive industry has among the longest, most complex supply chains. Steel, aluminum, glass, iron, copper, resin, rubber, and silicon (semiconductor chips) are among the long list of raw materials used to fashion the 30,000 parts (down to the individual bolt, washer, semiconductor chip and screws that make-up the average car). Automakers and their suppliers combine these parts into sub-components and components that are assembled into the finished motor vehicle. This highly complex supply chain is carefully orchestrated and managed to ensure the highest levels of efficiency, performance, and quality. All the inputs are competitively sourced from both domestic and international sources, which is necessary in a globally competitive industry often faced with razor thin profit margins.

When available, locally sourced parts are generally a more efficient, flexible, and resilient option given the shorter transportation pipeline, particularly when just-in-time manufacturing practices are used. But not all auto parts and components are available locally and some that are produced in the U.S. are not globally cost/quality/performance competitive even when the added transportation costs associated with sourcing foreign inputs are considered. Consequently,

[2] National Science Foundation-R&D by industry sector by 4-digit NAICS (3361-63)
[3] Automotive News Data Center U.S. Production by model -2019:2020

automakers must source inputs, including advanced technologies such as semiconductors, from wherever they are available and most competitively produced from a cost/quality/performance perspective. Given the increasing number of semiconductors used in today's vehicles, semiconductor supply chain risks to the U.S. auto sector have grown.

Semiconductor chips are integral to many electronic components used in motor vehicles to enhance driver safety, lower environmental emissions, and make a car "smarter" – which is particularly important as vehicles increasingly trend toward full automation. The manufacture of these electronic components relies heavily upon a global semiconductor industry that, in turn, relies on the silicon wafer industry. Today, between 1,000-1,400 semiconductor chips are used in an average car. These chips are worth between $400-$570 per car today[4] - growing to an average of $600 per car by next year.[5] A severe shortage of these "automotive-grade" wafers, and therefore chips, is behind the current crisis.

Auto grade semiconductor chips differentiate themselves from consumer electronic chips by their ability to withstand harsher environmental stresses (temperature, vibration, etc.) and require zero or near-zero failure rates, given the vital safety functions (e.g., braking and steering) that these chips often govern within a vehicle. While semiconductor chips are used for a variety of purposes (e.g., infotainment, EVs, and powertrain), the importance of semiconductors to active safety, including for Advanced Driver Assisted Systems (ADAS), the fastest growing segment of auto grade chips, cannot be overemphasized. [6]

Access to an adequate supply of automotive grade semiconductors is essential to the competitiveness of the American automotive industry. The use of semiconductors in motor vehicles is growing in parallel with the automotive industry's rapid transition to electrified powertrains and automation of the motor vehicle. According to estimates, the auto sector will represent about 10% of total global semiconductor chip revenue this year (2021),[7] but as automakers transition to EVs and AVs over the next two decades, that is forecast to dramatically increase to as high as 35% by 2040.[8] This steady growth in demand by the auto sector warrants the attention of policy makers, especially since smarter cars (i.e., EVs and AVs) will make significant contributions to the reduction of greenhouse gas emissions, while also promoting safer roadways and boosting economic growth.

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[4] IHS Global Insight

[5] – Deloitte https://www2.deloitte.com/content/dam/Deloitte/cn/Documents/technology-media-telecommunications/deloitte-cn-tmt-semiconductors-the-next-wave-en-190422.pdf.

[6] ADAS includes blind-spot detection and vehicle collision warnings, which has been the fastest growing segment of auto chip applications.

[7] The auto sector represents 10% of total global semiconductor chip revenue in 2021, up from 9% in 2020 and projected to be 12% 2022– Deloitte https://www2.deloitte.com/content/dam/Deloitte/cn/Documents/technology-media-telecommunications/deloitte-cn-tmt-semiconductors-the-next-wave-en-190422.pdf.

[8] According to KPMG, estimated revenue spent for automotive semiconductors is forecast to reach as high as $200B by 2040. This is estimated to be 35% of the overall semiconductor market - https://advisory.kpmg.us/content/dam/advisory/en/pdfs/2021/automotive-semiconductors.pdf https://advisory.kpmg.us/articles/2019/automotive-semiconductors.html.

It should be noted that the vast majority of semiconductor chips currently incorporated into a newly assembled motor vehicle do not use nor need the most advanced process nodes. The earlier generations nodes are perfectly sufficient for most chip functions, such as power seat functions. While there will be a growing demand for the latest generation process nodes for AV technologies, these will in the foreseeable future remain a small percentage of the total number of semiconductors used in a motor vehicle. Consequently, efforts aimed at increasing auto grade semiconductor production in the U.S. that do not include the production of earlier generation process nodes for automotive applications would have a limited impact in terms of improving the auto sector's supply chain resiliency.

The global semiconductor supply chain, worth more than $509 billion in 2020, is highly complex and interwoven into the U.S. economy.[9] The production of a single computer chip often requires more than 1,000 steps and crossing international borders numerous times before reaching an end customer. [10] The importance of semiconductors to numerous industries, including the automotive industry, makes open access to the global semiconductor supply chain critical to global competitiveness for America's automotive industry and our nation's economy.

While the U.S. leads all other countries in semiconductor R&D and the design of key types of chips (logic and analog semiconductor wafer/chip) - as well as in the supply of semiconductor manufacturing equipment - it has a significantly smaller share (geographically) of wafer/chip production. The U.S. global share of production has a broad range based on the type of semiconductor wafer/chip, but overall, it is estimated to be about 10% of overall global production.[11] This is low, especially for a country that represents the largest market for semiconductors. The remaining 90% is shared in large part with Taiwan, South Korea, Japan and China. The U.S. share of global automotive grade semiconductor wafer/chip production is equally small, with Taiwan as the dominate supplier.[12] It is widely recognized that the geographic specialization or concentration has created supply chain risks that should be addressed through government incentives to boost domestic chip production.[13]

[9] – Deloitte https://www2.deloitte.com/content/dam/Deloitte/cn/Documents/technology-media-telecommunications/deloitte-cn-tmt-semiconductors-the-next-wave-en-190422.pdf.
[10] The Semiconductor Supply Chain: Assessing National Competitiveness by CSET - https://cset.georgetown.edu/wp-content/uploads/The-Semiconductor-Supply-Chain-Issue-Brief.pdf
[11] The Semiconductor Supply Chain: Assessing National Competitiveness by CSET - https://cset.georgetown.edu/wp-content/uploads/The-Semiconductor-Supply-Chain-Issue-Brief.pdf
[12] IHS Global Insight
[13] SIA - https://www.semiconductors.org/strengthening-the-global-semiconductor-supply-chain-in-an-uncertain-era/

The Current Semiconductor Shortage Crisis

The current shortage of automotive grade semiconductors[14] has shutdown numerous automotive assembly plants, as well as auto parts and component manufacturing facilities, having a severe impact on American auto jobs and the communities they support.[15] Moreover, the U.S. auto sector has experienced the largest reduction in auto production compared to our global competitors.

This shortage has also had an outsized impact on the U.S. economy as a whole – due to the automotive industry's long, complex supply chains with its forward and backward linkages that have among the largest job multipliers (up to 14 supporting jobs for every one direct auto assembly plant job). In addition to addressing the current shorter-term crisis by securing commitments from chip and wafer makers to commit to fulfil all automotive orders, there is also the need to address the underlying cause of this crisis with longer-term policies and solutions.

The lack of transparency within the semiconductor supply chain makes it nearly impossible to clearly identify the problem and address the gaps in the system. A higher level of transparency would make it possible to execute a better business plan in order to better manage the current shortage (see transparency proposal below).

The Need for Long-Term U.S. Government Engagement

In parallel with efforts to swiftly resolve the current semiconductor shortage crisis, American Automakers are working with the Administration and members of Congress on both sides of the aisle to find legislative and policy solutions to help avoid this type of acute crisis from happening again. While market-based solutions are generally preferred, there is a growing recognition of the need for the U.S. government to play a more active role to improve supply chain resiliency and reduce the national security/economic risk associated with the industry's reliance on foreign chipmakers.

The important role for the U.S. government stems from a clear over-concentration of the semiconductor manufacturing industry in a handful of manufacturers (e.g., 56% of auto grade chips include wafers made by one manufacturer), the trend towards offshore mega

[14] What is an "automotive grade" Semiconductor: It is a semiconductor chip that meets the Automotive Electronics Council (AEC's Component Technical Committee, comprised of nearly all the global Tier 1 suppliers has established detailed qualifications See, http://www.aecouncil.com/. When met, the part/component is considered AEC qualified. (e.g., AEC Q100 & AEC Q101) . *AEC (Automotive Electronics Council) standards including but not limited to AEC-Q100, Q101, Q102, Q103, Q104, Q200, Q001 – 006"* These and the other AEC documents (see list above) define minimum, stress test-driven qualification requirements (i.e., "automotive grade" requirements).

[15] Cite Articles announcing plant shutdowns…

manufacturing facilities, and relatedly the very high cost of building and maintaining semiconductor manufacturing facilities (e.g., each wafer fabrication facility represents tens of billions of dollars). These factors, combined with the growing strategic importance of semiconductors for automotive technologies of the future, has rightfully raised national and economic security implications.

AAPC Proposals

To improve our supply chain resiliency, reduce overreliance on foreign suppliers, and meet the expected increase in demand for auto-grade semiconductors, any longer-term solutions must include measures to increase overall supply and re-shore automotive-grade semiconductor manufacturing to the United States.

The auto sector has an outsized impact on our economy. American Automakers employ more than 241,000 U.S. workers – or two out of every three U.S. automaker jobs and American Automakers' U.S. jobs support a larger ecosystem of suppliers, dealers, and other local businesses. Automakers in the U.S. directly employ about 381,000 American workers, and they support approximately 7.25 million U.S. jobs. Given that, we firmly believe that special emphasis should be placed on re-shoring policies that will benefit American workers – especially any policies that will involve a cost to American taxpayers.

Meanwhile, although our counterpart companies in the consumer electronics industry spend much of their R&D in the U.S. and maintain corporate headquarters here, most – if not all – of their products and components are made and assembled overseas. This is a critically important difference between the automotive and consumer electronics industries – that should be front and center when employing policies aimed at supporting and growing American jobs.

We were encouraged by passage of measures included as part of the FY 2021 National Defense Authorization Act (FY2021 NDAA) legislation. We are working with the Administration and Congress to help secure funding that would provide federal grants to incentivize the construction of new semiconductor facilities here in the United States. As part of those efforts, we hope to ensure that a portion of these funds will be dedicated to support the construction U.S. semiconductor manufacturing facilities that are capable of making auto-grade wafers/chips, while also retaining the ability to manufacture earlier generations of process nodes.

We therefore propose that significant portion of any federal funding goes to construction of U.S. facilities that commit to producing auto grade chips. This is important as it is projected that the demand from the auto sector will grow from 10% of total global consumption to 35% by 2040 (a 7.7% annual increase). This support is only needed for a limited time. As the auto grade percentage of the total revenues/production increases, the need to maintain an incentive programs for the auto sector will diminish, due to the market clout that the auto sector gains. This special attention to the auto sector is realistic and reasonable as it reflects the economic

benefit and return to American taxpayers from making this investment given the outsized impact of the U.S. automotive sector.

While actions to mitigate the immediate shortage have shown some positive results, we would urge the Biden Administration to continue working to resolve the short-term crisis as it explores way to prevent this problem in the future.

The current semiconductor supply chain crisis has undeniably exposed overall capacity limits in the semiconductor sector and revealed significant risks in the current automotive semiconductor supply chain. There is a clear need to expand semiconductor capacity to meet the growing demand for semiconductors in the auto industry and across the economy. Policies that can incentivize this additional capacity in the United States are essential to addressing the longer-term challenges.

AAPC strongly supports full funding for the programs designed to incentivize additional capacity in the United States. A significant portion of the funding from these federal programs should be used to increase the resiliency of automotive supply chains through the construction or support of facilities that produce auto grade chips.

Increasing transparency within the semiconductor supply chain can also play an important role in alleviating the impact of the semiconductor shortage by providing a snapshot of current semiconductor supply and demand down to the level of node technology. This information will allow automakers to employ more effective business planning to better manage the current shortage and mitigate future shortages, which will benefit U.S. autoworkers and the communities they support throughout the country.

Again, AAPC applauds the FCC's attention to this important issue. We look forward to working with the FCC to ensure that the U.S. automotive industry has the supplies and tools necessary to lead the world in the automotive industry's cutting-edge technology.